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| EXAMINER | |
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/541,298 | WINDISCH ET AL. | |
| | Examiner | Art Unit | |
| | Nathan H. Empie | 1709 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *17 January 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-17 and 20-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17 and 20-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 June 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *6/30/05, 6/4/07*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Specification*

The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: Claims 20 and 21 contain subject matter that was not described in the specification. The chemistry of aluminum gallium indium **phosphate** as claimed has not been expressed in the specification, which has only described aluminum gallium indium **phosphite**.

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 4, 6-9, and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Cathey et al. (US patent 5,753,130, hereafter '130).

3. '130 teaches a method for roughening a surface of a body (abstract), having the following steps of:

4. a) coating the surface with a mask layer (layer 30, Fig 2. col 6 lines 8-15)

5. b) applying preformed mask bodies (elements 32, Fig 2. col 6 lines 22-36) on the mask layer (layer 30)

6. c) etching through the mask layer (layer 30) at locations not covered by mask bodies (layer 32) (Fig. 3, col 6 lines 49-53)

7. d) etching the body (11/13) at locations of its surface that are free of the mask layer (Fig. 4, col 7 lines 11-16).

8. Claim 4: '130 teaches the method as claimed in claim 1 (described above), the mask layer (layer 30) comprising a dielectric (in present invention layer 30 is silicon dioxide, col 6 lines 8-11).

9. Claim 6: '130 teaches the method as claimed in claim 1 (described above), the etching steps being carried out by means of a dry etching method (process of present invention employs dry etching to fabricate tips, col 2 lines 55-59, col 6 lines 49-53, col 7 lines 11-16).

10. Claim 7 and 8: '130 teaches the method as claimed in claim 1 (described above), the method being carried out in such a way that structures (tips 13) remain in the surface of the body (substrate 11) (Fig 7, col 7 lines 31-45), for the width (b) of which structures in relation to the etching depth (t) the following holds true: $0.1<t/b<10$, further: $0.25<t/b<5$, (tips (13) possessing heights (t) of 0.70-1.75μm, and tip widths (b) of 1-1.5μm are taught (for a range of $0.467 < t/b < 1.75$) (col 7 lines 36-45)).

11. Claim 9: '130 teaches the method as claimed in claim 1 (described above), the residues of the mask body (layer 32) being removed from the mask layer (layer 30) immediately after step c) (The beads 32 are removed, col 6 line 65).

12. Claim 11: '130 teaches the method as claimed in claim 1 (described above), the mask layer (layer 30) being applied with a thickness (d) of between 10 and 100 nm (in the present invention layer 30 is deposited at 0.1 μm (or 100 nm) col 6 lines 8-11).

13. Claims 1, 4-6, 9, and 14 are rejected under 35 U.S.C. 102(b) as being anticipated by Knappenberger et al. (US 2002/0003125 A1, hereafter '125).

14. '125 teaches a method for roughening a surface of a body (substrate 11) (Fig 7, Abstract), having the following steps of:

15. a) coating the surface with a mask layer (layer 12) [0030, 0034] (Fig 2)

16. b) applying preformed mask bodies (layer 10) on the mask layer (layer 12) [0030, 0033] (Fig 2)

17. c) etching through the mask layer (layer 12) at locations not covered by mask bodies (layer 10) [0033] Fig 4

18. d) etching the body (substrate 11) at locations of its surface that are free of the mask layer [0034-35] Fig 6).

19. Claim 4: '125 teaches the method as claimed in claim 1 (described above), the mask layer (layer 12) comprising a dielectric (silicon dioxide)([0033]).

20. Claim 5: '125 teaches the method as claimed in claim 1 (described above), balls made of polystyrene being used as preformed mask bodies (elements / layer 10) (second half of [0030] states spheres 10 are preferably polystyrene).

21. Claim 6: '125 teaches the method as claimed in claim 1 (described above), the etching steps being carried out by means of a dry etching method (reactive ion etching [0033] / plasma etching [0035]).

22. Claim 9: '125 teaches the method as claimed in claim 1 (described above), the residues of the mask body (10) being removed from the mask layer (12) immediately after step c) (Fig 4 to Fig 5, [0034]).

23. Claim 14: '125 teaches the method as claimed in claim 1 (described above), the etching through the mask layer (layer 12) being effected by means of an installation for reactive ion etching (reactive ion etching process is described to be performed on layer 12, [0033]).

24. Claim 1, 4-5, 9, and 13 are rejected under 35 U.S.C. 102(b) as being anticipated by Michiels et al. (US 2001/0014426; hereafter '426)

'426 teaches a method for roughening a surface of a body (layer 14) (Fig 10-14, Abstract), having the following steps of: a) coating the surface with a mask layer (masking layer 40) (Fig 10, [0052-53])

b) applying preformed mask bodies (masking particles (46)) on the mask layer (masking layer 40) (Fig 10, [0054,66,67])

c) etching through the mask layer (40) at locations not covered by mask bodies (46) (Fig 11, [0068])

d) etching the body (14) at locations of its surface that are free (60) of the mask layer (40/56) (Fig 12 and 13, [0069-70]).

25. Claim 4: '426 teaches the method as claimed in claim 1 (described above), the mask layer (layer 40) comprising a dielectric (silicon dioxide)([0053]).

26. Claim 5: '426 teaches the method as claimed in claim 1 (described above), balls made of polystyrene being used as preformed mask bodies (46) ([0055]).

27. Claim 9: '426 teaches the method as claimed in claim 1 (described above), the residues of the mask body (46) being removed from the mask layer (40) immediately after step c) (Fig 11-12, [0069]).

Claim 13: '426 teaches the method as claimed in claim 1 (described above), the first etching step being effected by means of a process step which etches the mask bodies (46) to a greater degree than the body (14) (acetone is utilized to remove masking particles and feet from surface of (14) without significant etching of 14) (Fig 11-12, [0069]).

28. Claim 1 4-5, 9, and 12 are rejected under 35 U.S.C. 102(b) as being anticipated by Alwan (US patent 5,676,853; hereafter '853)

'853 teaches a method for roughening a surface of a body (layer 14) (Fig 6-8, col 3 lines3 - 10), having the following steps of: a) coating the surface with a mask layer (oxide layer 16) (Fig 2, col 4 lines 7 - 16)

b) applying preformed mask bodies (mask particles (24)) on the mask layer (oxide layer 16) (Fig 2, col 4 lines 25-42)

c) etching through the mask layer (16) at locations not covered by mask bodies (24) (Fig 5 and 6, col 6 lines 4-18, col 7 lines 1-7)

d) etching the body (14) at locations of its surface that are free of the mask layer (16) (Fig 8, col 7 lines 17-30).

29. Claim 4: '853 teaches the method as claimed in claim 1 (described above), the mask layer (layer 16) comprising a dielectric (oxide layer) (col 4 lines 7-16).

30. Claim 5: '853 teaches the method as claimed in claim 1 (described above), balls made of polystyrene being used as preformed mask bodies (24) (col 6 lines 19-30).

31. Claim 9: '853 teaches the method as claimed in claim 1 (described above), the residues of the mask body (24) being removed from the mask layer (16) immediately after step c) (Fig 6-7, col 7 lines 1-16).

*32.* Claim 12: '853 teaches the method as claimed in claim 1 (described above), the mask bodies (mask particles (24), on the mask layer (16), having a lateral extent (A) (a diameter) of between 150 and 300 nm (between 200-5000 nm) (claim 12).

***Claim Rejections - 35 USC § 103***

33. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

34.

35. Claim 2, 20, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over '130 in view of Olson (US patent 5,342,453, hereafter '453).

36. Claim 2: '130 teaches the method as claimed in claim 1 (described above), the body (substrate 11) containing a material from which the emitter tip can be fabricated which can be one any suitable material from which a micro cathode (13) (emitter or tip) can be fabricated (col 5 lines 1-28), '130 does not teach that the body containing aluminum gallium indium phosphite. '453 teaches that a layer of

AlGaInP successfully functions as a material for an emitter layer (col 2 line 66- col 3 line14). The motivation to select the AlGaInP material for the micro cathode is that it functions as a suitable material from which an emitter can be fabricated. Thus it would have been obvious to one of ordinary skill in the art at the time of invention to have selected the AlGaInP material described by '453 as the substrate material (11) described by '130 as '130 had suggested that suitable alternative substrates could be used.

37. Claim 20, 21: '130 teaches an optoelectronic component (field emission display (22)), comprising: a semiconductor body (substrate 11) and having a surface that is patterned with structures (patterned field emitter tips (13) (Fig 1,7) (col 1 lines 25-48, col 5 lines 1-50);

38. '130 teaches wherein each of said surface structures has a ratio of depth (t) to width (b) that is in accordance with the relationship $0.1 < t/b < 10$; further $0.25 < t/b < 5$ (tips (13) possessing heights (t) of 0.70-1.75 μm, and tip widths (b) of 1-1.5 μm are taught (for a range of $0.467 < t/b < 1.75$) (col 7 lines 36-45)). 130' teaches the body (substrate 11) can be one any suitable material from which a micro cathode (13) (emitter or tip) can be fabricated (col 5 lines 1-28), '130 does not teach a component containing aluminum gallium indium phosphate, '453 teaches that a layer of AlGaInP successfully functions as a material for an emitter layer (col 2 line 66- col 3 line14). The motivation to select the AlGaInP material for the micro cathode is that it functions as a suitable material from which an emitter can be fabricated. Thus it would have been obvious to one of ordinary skill in the art at the time of invention to have selected the AlGaInP material described by '453 as the substrate material (11) described by '130 as '130 had suggested that suitable alternative substrates could be used.

39. Claim 3, 22, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over '130 in view of Siegrist (US 2002/0007792 A1, hereafter '792).

40. Claim 3: '130 teaches the method as claimed in claim 1 (described above), the body (substrate 11) containing a material from which the emitter tip can be fabricated which can be one any suitable

material from which a micro cathode (13) (emitter or tip) can be fabricated (col 5 lines 1-28), '130 does not teach that the body containing aluminum gallium indium nitride. '792 teaches that aluminum-gallium-indium-nitride alloys can perform as cathode materials [0012]. The motivation to select the AlGaInN material for the micro cathode is that it functions as a suitable material from which an emitter can be fabricated. Thus it would have been obvious to one of ordinary skill in the art at the time of invention to have incorporated the AlGaInN material described by '792 as the substrate material (11) described by '130 as '130 had suggested that suitable alternative substrates could be used.

41. Claim 22, 23: '130 teaches an optoelectronic component (field emission display (22)), comprising: a semiconductor body (substrate 11) and having a surface that is patterned with structures (patterned field emitter tips (13) (Fig 1,7) (col 1 lines 25-48, col 5 lines 1-50));

42. '130 teaches wherein each of said surface structures has a ratio of depth (t) to width (b) that is in accordance with the relationship $0.1 < t/b < 10$; further $0.25 < t/b < 5$ (tips (13) possessing heights (t) of 0.70-1.75 μm, and tip widths (b) of 1-1.5 μm are taught (for a range of $0.467 < t/b < 1.75$) (col 7 lines 36-45). 130' teaches the body (substrate 11) can be one any suitable material from which a micro cathode (13) (emitter or tip) can be fabricated (col 5 lines 1-28), '130 does not teach a component containing aluminum gallium indium nitride, '792 teaches that aluminum-gallium-indium-nitride alloys can successfully perform as cathode materials [0012]. The motivation to select the AlGaInN material for the micro cathode is that it functions as a suitable material from which an emitter can be fabricated. Thus it would have been obvious to one of ordinary skill in the art at the time of invention to have incorporated the AlGaInN material described by '792 as the substrate material (11) described by '130 as '130 had suggested that suitable alternative substrates could be used.

43. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kawasaki et al. (US patent 5,240,558; hereafter '558) in view of 130'

'558 teaches a method for roughening a surface of a body (layer 16) (Fig 1-5, Abstract), having the following steps of: a) coating the surface with a mask layer (buffer layer 18) (Fig 2, col 2 line 65 – col 3 line 2)

b) applying mask bodies (non-coalescing islands 20) on the mask layer (buffer layer 18) (Fig 3, col 3 lines 3-24)

c) etching through the mask layer (18) at locations not covered by mask bodies (20) (Fig 4, col 3 lines 25-34)

d) etching the body (16) at locations of its surface that are free of the mask layer (18) (Fig 5, col 3 lines 35-41).

'558 does not teach that the mask bodies were preformed. '125 teaches applying preformed mask bodies (layer 10) on the mask layer (layer 12) [0030, 0033] (Fig 2). The motivation to incorporate preformed spheres as mask bodies into the method taught by '558 would be that it would increase the uniformity between mask bodies allowing for more uniform, etched surface features. Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to have used the spheres described by '125 as the mask bodies for the method described by '558 as it would lead to an increase in the uniformity of the etched surface features.

44. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over '558 in view of '125 as applied to claim 1 above, and further in view of Muller et al. (US 2002/0162999 A1, hereafter '999)

45. '558 in view of '125 teach the method as claimed in claim 1 (described above), where a body (polysilicon surface electrode (16)) is etched with a coated mask to produce a roughened surface to offset the reduction in size of other semiconductor features ('558, col 1 lines 1 – 50), but neither '558 nor '125 specify the etching depth (t) in the body as being between 50 and 100 nm. '999 teaches the masked etching of a polysilicon doped surface (silicon layer or substrate 12) to an etching depth of about 20-50

nm (Fig 1,2 [0021]). In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976). The motivation to select an etching depth range of 20-50 nm would be to yield a silicon substrate surface with sufficiently small features capable of obtaining increased performance and functionality when integrated into a circuit ('999 [0004]). Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to have selected an etching depth within the claimed range as taught by '999 into the method of '558 to have increased the performance and functionality of the substrate.

46. Claim 15 is rejected under U.S.C 103(a) as being unpatentable over '125 in view of '130.

47. '125 teaches the method as claimed in claim 14 (described above), but '125 does not teach a mixture of $CHF_3$ and Ar being used as etching gas. '130 teaches the use of an etchant gas comprising $CF_2$, $CHF_3$, and argon were used to plasma etch silicon dioxide, as these etchant gases are selective with respect to silicon. The motivation to select an etchant gas comprising $CF_2$, $CHF_3$, and argon for an etching process involving a silicon dioxide etch mask and a silicon substrate is that '130 teaches that this gas mixture would be selective to the silicon substrate. Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to have incorporated the etching gas mixture described by '130 into the process of etching a silicon wafer with a silicon dioxide resist taught by '125 as it would have provided an etching gas with a suitable selectivity with respect to silicon.

48. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over '125 in view of Huang et al. (US 2002/0176474; hereafter '474).

49. '125 teaches the method as claimed in claim 1 (described above), the body (substrate 11) being etched by means of plasma etching [0035]. But '125 does not specify an installation suitable for an

inductively coupled plasma. '474 teaches an inductively coupled etch (ICP) process to etch a semiconductive substrate ([0104]). The motivation to incorporate an installation for ICP to perform the claimed etch process is because ICP provides the benefits of high aspect ratio and comparatively low ion energies ('474 [0104]). Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to have selected the ICP process as taught by '474 to perform the etch process taught by '125 because it would reap the benefit of high aspect ratio and comparatively low ion energies.

50.

51. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over '125 in view of '474 as applied to claim 16, and further in view of '453 and Shul et al. (US patent 5,624,529; hereafter '529).

52. '125 in view of '474 teach the method as claimed in claim 16 (described above), but neither '125 nor '474 teach a mixture of $CH_4$ and $H_2$ being used as etching gas. The etching composition disclosed by '125 was tailored to a to silicon substrate [0035], but an alternate material suitable to perform as a micro cathode could also be used instead [0030]. '453 teaches that a layer of AlGaInP successfully functions as a material for an emitter layer (col 2 line 66- col 3 line14). The motivation to select the AlGaInP material for the micro cathode is that it functions as a suitable material from which an emitter can be fabricated. Thus it would have been obvious to one of ordinary skill in the art at the time of invention to have selected the AlGaInP material described by '453 as the substrate material (11) described by '130 as '130 had suggested that suitable alternative substrates could be used.

53. If a material consisting of AlGaInP was used in the etching process it would have been obvious that a preferred etching solution should have been used. '529 teaches such a suitable etchant for etching a GaInP/AlGaInP material (emitter material, capable of performing the function of a micro cathode), where the etchant is composed of 2 sccm $CH_4$ and 20 sccm $H_2$ (col 6 lines 42-60). The motivation to select the etchant taught by '529 with the process described by '125 would be that suitable etchants should be used for various substrates, no one chemistry is sufficient for all systems, so for processing (for example) a

GaIn/AlGaInP substrate, '529 recommends an appropriate chemistry. It would have been obvious of one of ordinary skill in the art at the time of invention to have utilized the etchant chemistry of '529 into the process described by '125 as it teaches a recommended dry etching chemistry to be used when etching GaIn/AlGaInP materials.

***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure as they teach the generation of surface features: US 5,825,122, 5,949,182, and US 6,201,342.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nathan H. Empie whose telephone number is (571) 270-1886. The examiner can normally be reached on M-F, 7:30- 5:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on (571) 272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

NHE NHE

MICHAEL B. CLEVELAND
SUPERVISORY PATENT EXAMINER